Using WiFi to see through walls

Sebastian Anthony

Subscribe Today to get the latest ExtremeTech news delivered right to your inbox.

British engineers from University College London have developed a passive radar system that can see through walls using the WiFi signals generated by wireless routers and access points.

The system, devised by Karl Woodbridge and Kevin Chetty, requires two antennae and a signal processing unit (i.e. computer), and is no larger than a suitcase. Unlike normal radar, which emits radio waves and then measures any reflected signals, this new system operates in complete stealth.

The passive radar process is actually quite simple. In any space that has WiFi, you are constantly being bombarded by 2.4GHz and 5GHz radio waves. When these waves hit a moving object, their frequency is altered (the Doppler effect). By carefully "sniffing" the WiFi signals, Woodbridge and Chetty are able to reconstruct an image any objects or humans that are moving on the other side of the wall.

Fundamentally, this is a radar system -- you're just using radio waves that have been emitted by an external WiFi router, rather than creating your own. Compare this with MIT's through-the-wall (TTW) radar, which is 8 feet (2.4m) across and requires a large power source to generate lots and lots of microwaves.

In testing, this passive radar system is able to detect a person's location, speed, and direction, through a foot-thick brick wall. One problem with Doppler-based systems is that they only work with moving objects -- a would-be burglar or combatant can thwart these systems by standing still. With further work, though, the UCL engineers think they can increase the sensitivity of the system so that it can detect the movement of your ribcage as you breathe in and out.

The use cases, as you can imagine, are mainly militaristic. The UK Ministry of Defence is already looking into whether this passive radar could be used in urban warfare. PopSci(Opens in a new window) speculates that passive radar could be useful for tracking the movements of children (or the elderly) throughout the house. Presumably, with sensitive equipment (and a lot of WiFi routers?) you might even get close to X-ray vision.

Woodbridge and Chetty seem to be passive radar specialists: They were apparently the first researchers to build a radar system using software-defined radio gear, and they've also done the same passive WiFi radar trick with WiMAX -- which presumably allows for much longer range detection.

Read the research paper: 10.1109/TGRS.2011.2164411(Opens in a new window), "Through-the-Wall Sensing of Personnel Using Passive Bistatic WiFi Radar at Standoff Distances" [paywalled]

[Image credit(Opens in a new window)]